The Australian Pigmy-Possums

By N. A. Wakefield*

The pigmy-possums are among the smallest of the Australian possum family, the Phalangeridae. Adults are about 3 to 4½ inches long in body, and the tail is usually somewhat longer. General body colour is grey or brown, with the under parts light grey or white. The tail is prehensible and, except for the well-furred basal half-inch, is practically naked. There is a dark patch about each eye; and in life the muzzle, ears, feet and tail are pinkish. The natural diet is restricted completely or almost so to nectar, insects and other arthropods.

Of the four Australian species, two have been placed in the genus *Cercartetus* and two in *Eudromicia* (e.g. by Troughton, 1957). However, for reasons set out in the Appendix to this paper, all four should be classified as *Cercartetus*. Furthermore, the pigmy-possum of tropical Queensland (*"Eudromicia macrura"*) is not specifically distinct from that of New Guinea, and the two populations should be grouped together as *Cercartetus caudatus*.

Following are key features by which pigmy-possums may be specifically identified:

C. nanus attains about 8 to 9 inches (20-25 cm.) in total length. The posterior upper premolar (P^4) has two large well-separated triangular cusps.

In the following three species, P^4 is only slightly bilobed.

C. concinnus attains about 6 to 7 inches (15-18 cm.) in total length, and the belly fur is white right to the base. The posterior lower premolar (P_4) is a minute peg-like tooth.

In the following two species, and in *nanus*, under-fur is grey except at the tips, and P_4 is about as large as the neighbouring molars.

The two preceding species are distributed in temperate Australia, south of latitude 30°S, with *nanus* in the south-eastern part and *concinnus* in the central and western portions of this range.

Fourth molars are lacking in *nanus* and *concinnus* but are present in *lepidus* and *caudatus*.

C. lepidus attains about 6 inches in total length. It is confined to Tasmania.

C. caudatus is about as big as *nanus* in body but its exceptionally long tail gives it a maximum total length in excess of 10 inches (25 cm.). It occurs in north-eastern Queensland and New Guinea.

In both *nanus* and *lepidus*, much subcutaneous fat is accumulated seasonally, and both body and tail thicken conspicuously. There is little such fattening in either *concinnus* or *caudatus*.

In the group the normal number of mammae is four, but *concinnus* is exceptional in having six.

As regards vernacular names, *concinnus* is well suited with the aboriginal "Mundarda", and *nanus* is referred to simply as "Pigmy-possum". Long-tailed Pigmy-possum seems most suitable for *caudatus*, and Little Pigmy-possum equally appropriate for *lepidus*.

Taxonomy

Cercartetus nanus

The species was originally described as *Phalangista nana*, by Desmarest in 1818, and the type specimen was collected on Maria Island, off eastern Tasmania, in February 1802. Péron (1807)

* Department of Zoology and Comparative Physiology, Monash University, Clayton, Victoria.

describes its acquisition thus (in translation):

I received a living individual in exchange for some trifles which I offered to a savage who was about to kill it to eat.

The specimen was subadult, and it is preserved in the Muséum d'Histoire Naturelle, Paris.

Adults of the Tasmanian form have a warm brown infusion in the general body colour and are yellowish on the sides and underneath. Bell (1829) included these points in his description of *Phalangista gliriformis*, the locality of which was simply given as "Australia". Though Tate (1945) suggested that the name may apply to the mainland form, there is no doubt that the original specimen was Tasmanian and that *gliriformis* is a synonym of *C. nanus nanus*.

On the Australian mainland the species escaped notice until Krefft (1863) described *Dromicia unicolor* from the North Shore area of Sydney. Subsequently, Jones (1925) described a specimen from Millicent, South Australia, as *Dromicia britta*.

Iredale and Troughton (1934) recognized both *unicolor* and *britta* as distinct subspecies. However, the specimens now available demonstrate that *nanus* is reasonably uniform and continuous in distribution from South Australia to far-eastern Victoria and thence north into New South Wales.

In general, the mainland Pigmy-possum is less brown and less yellow than the Tasmanian. The Australian population may be distinguished as *C. nanus unicolor*, with *Dromicia britta* as an equivalent synonym.

Cercartetus concinnus

The second species of the genus was originally described by Gould (1845) as *Dromicia concinna*, the type of which was from Swan River, Western Australia. Shortly afterwards, Waterhouse (1846) named *Phalangista neillii*, from King George's Sound. The latter is an equivalent synonym of the former.

Members of the Western population of *concinnus* are a dusky fawn-brown colour; and a sample of over seventy specimens in the Perth Museum averaged 165 mm. in total length, while fourteen of them were 180 mm. or more. This south-western group constitutes the nominate subspecies, *C. concinnus concinnus*.

The South Australian and Victorian population of the species is geographically isolated from that of Western Australia, and the two groups differ appreciably in morphology. The eastern population needs taxonomic recognition and is therefore designated as follows:

Cercartetus concinnus minor, new subspecies. Differs from *C. c. concinnus* in (a) smaller size; (b) nasals shorter in proportion to length of skull; and (c) distribution east of Great Australian Bight. *Holotype*: Male; Nurcoung, 10 m. NW. of Natimuk, Vic.; Sept. 1962; F.W.D., No. 328.

Measurements to date indicate that the total length of *C. c. minor* does not exceed 175 mm. and averages about 6 per cent less than in *C. c. concinnus*. Cranial measurements are set out in Table 1.

Older individuals of *minor* sometimes become warm red-brown in general body colour, a

TABLE 1

Cranial details of *Cercartetus concinnus*. (In mms, averages in parenthesis)

	C. c. concinnus Data of 21 spms., West. Aust.	*C. c. nanus* Data of 18 spms., S. Aust. and Vic.
Basal length (B.L.)	17.9-20.1 (18.9)	16.8-19.4 (18.0)
Zygomatic width (Z.W.)	14.0-14.9 (14.3)	13.2-14.3 (13.6)
Z.W./B.L. (as percentage)	73.6-78.7 (76.1)	74.0-80.0 (76.7)
Nasals, length (N.L.)	7.8-9.4 (8.6)	7.2-8.4 (7.9)
N.L./B.L. (as percentage)	44.0-48.7 (45.7)	40.7-45.6 (42.8)
Molars (M^2-M^4), alveolar	2.4-2.8 (2.6)	2.4-2.8 (2.6)

feature that has not been noted amongst the western race.

Cercartetus lepidus

Thomas (1888) described the species, as *Dromicia lepida*, using a specimen which reached the British Museum in 1852. Now confined to Tasmania, the population there comprises the nominate subspecies, *C. lepidus lepidus*.

Fossil and sub-fossil remains of the species have been identified from the Australian mainland. Though this material is to be studied in detail, it is probably insufficient to demonstrate the subspecific variation that might be expected from the Tasmanian form.

Cercartetus caudatus

The species was described, as *Dromicia caudata*, by Milne-Edwards, in 1877, from the Arfak Mountains of far north-western New Guinea. Tate and Archbold (1937) published data of four specimens from Central Papua and three from the Huon Peninsula of north-eastern New Guinea, and commented on the smaller teeth of the former series.

Laurie (1952) tabulated details of eleven specimens from various localities in north-eastern New Guinea and three from eastern Papua. She noted that the colour of pelage of all specimens was very similar but that two from one north-eastern locality (Bubu River) were larger than the others and compared with Tate and Archbold's central Papuan group.

In eastern New Guinea, the Long-tailed Pigmy-possum is warm red-brown in general body colour, with the under parts cream-buff and the eye-patches black.

No detailed information is available about the north-western population represented by the type specimen of *caudatus*, and this originated 800 and more miles from the loci of the New Guinea specimens of which there are reasonably full data. In the circumstances, all the New Guinea populations of the species must be tentatively grouped as *C. caudatus caudatus*.

In the original description of *Eudromicia macrura*, from north-eastern Queensland, Mjöberg (1916) stated that its body was much longer but tail shorter than in *caudata*. However, for the two Queensland specimens of which he published measurements, the tail averaged 152 per cent of the head-body length; and exactly the same average percentage is obtained from the measurements given by Laurie

TABLE 2

Cranial details of specimens of *Cercartetus caudatus*
Measurements in millimetres, averages in parenthesis

	C. c. caudatus					*C. c. macrurus*			
	Type, Arfak Mts., after Thomas.	*Data of 4 spms., eastern New Guinea, summarized from Tate and Archbold.*	*Data of 2 spms., Baiia River, after Laurie.*	*Data of 11 spms., eastern New Guinea, summarized from Laurie.*	*Spm., Mt. Giluwe, C.S.I.R.O., No. E.M. 523.*	*Spm., Jordan Cr., Q. Mus., No. J. 657 L.*	*Spm., Tinaroo, A.M., No. M. 5133*	*Spm., A.M.N.H., No. 55690.*	*Type, Cedar Cr., after Mjoberg.*
Basal length (B. L.)	24·4	24·6–26·2 (25·4)	25·2, 25·8	22·6–25·1 (23·9)	23·3	21·5	23·2	24·6	25·5
Zygomatic width (Z. W.)	18·0	16·3–18·0 (17·4)	17·6, 18·0	15·4–17·1 (16·1)	15·6	16·3	17·2	17·3	20·0
Z. W./B. L. (as percentage)	73·9	65·9–69·6 (68·5)	69·8, 69·8	66·1–69·9 (67·4)	67·0	75·8	74·1	70·3	78·4
Interorbital width	5·7	5·4–5·6 (5·5)	5·4, 5·2	5·0–5·7 (5·3)	5·2	5·1	5·4	5·1	6·0
Nasals, Length	11·0	—	11·7, 11·5	10·5–12·1 (11·4)	11·1	10·2	11·4	11·6	11·0
Nasals, width	4·2	—	3·6, 3·9	3·4–3·9 (3·7)	3·3	3·8	3·9	3·7	4·3
Palate, length	14·6	14·9–15·7 (15·3)	15·6, 15·5	13·8–15·5 (14·7)	14·6	12·6	14·4	14·9	—
Anterior palatal foramina	—	2·2–2·6 (2·4)	2·4, 2·1	2·0–2·4 (2·1)	2·0	2·1	2·0	2·5	2·0
Molar row (M^1–M^3)	4·6	4·3–4·7 (4·6)	4·6, 4·6	4·1–4·5 (4·3)	4·7	4·1	4·2	4·2	—
Bulla, length	—	—	—	—	4·7	5·0	4·7	5·0	—

(*l.c.*) for thirteen New Guinea specimens.

(When a summary was made of published measurements of *caudatus*, it was noted that increase in body length often seemed to be coupled with decrease in tail length, indicating lack of conformity in measuring techniques rather than actual variation in the species.)

Tate (*l.c.*) noted that the type of *macrurus* was smaller than one of his Papuan specimens of *caudatus* and that it had larger bullae and larger anterior and posterior palatal foramina, but was otherwise the same. These differences are not supported in the series of specimens now available.

Cranial details of the Long-tailed Pigmy-possum from Queensland and New Guinea are set out in Table 2. The two groups are virtually identical in all measurements except zygomatic width. In the four Queensland specimens, the width of the skull is over 70 per cent of the basal length, whereas in 18 out of 19 New Guinea specimens it is under 70 per cent.

Compared with the New Guinea animal, the Queensland pigmy-possum is much lighter in

colour. The general body colour is light chocolate-brown, with the under parts whitish-grey and the eye-patches brown.

The Queensland population should be subspecifically distinguished as *C. caudatus macrurus*.

Distribution and Habitat

Cercartetus nanus nanus

Of the seventeen specimens of *nanus* held by the B.M. (British Museum (Natural History)), sixteen are from Tasmania. Fifteen of these were collected between 80 and 140 years ago and their precise localities are not recorded; the other is from Hobart and was acquired in 1929. (The seventeenth is a mainland specimen, the type of *Dromicia britta*.)

The N.M.V. (National Museum of Victoria) has five specimens of *nanus* from Tasmania but none of them has exact locality data. Four were acquired in 1872 and the other in 1923. In the A.M. (Australian Museum, Sydney), there are six Tasmanian specimens, three of which were acquired in 1877 and three between 1915 and 1920, but again with no locality data.

In the Queen Victoria Museum, Launceston, there are six specimens of *nanus*, one from Magnet near Waratah in 1900, and the others from Launceston, Westbury district, and Fury Gorge near Cradle Mountain, within the past three years. The Tasmanian Museum, Hobart, has a specimen from Cloudy Bay, Bruny Island.

Hickman and Hickman (1960) reported finding two specimens of *nanus* at 3000 feet elevation on the slopes of Mount Wellington, in 1957. Each had burrowed down into the rotted centre of a dead stump but no material had been carried in for nest-making.

Gould (1846) was able to state that *nanus* was "abundant . . . in Van Diemen's Land, particularly in the northern parts of the island." In contrast with that, reports from both local museums indicate that it is now rare in Tasmania. These details suggest a marked decline in the status of the Tasmanian population of *nanus* during the past century.

There is very little information about habitats of the species in Tasmania. The Magnet and Fury Gorge specimens were caught in wet sclerophyll forests of beech (*Nothofagus*), and those from Bruny Island and Maria Island were presumably in dry sclerophyll forests.

Cercartetus nanus unicolor

On the Australian mainland, little indeed was known of *nanus* until the present century. Thomas (*l.c.*) suggested that Krefft's Sydney specimens were escapees which had originated in Tasmania. However, Broom (1896) reported finding jawbones* of the species in the Wombeyan Caves area of New South Wales, and he was most emphatic that both they and Krefft's specimens represented a modern mainland population. A specimen reached the A.M. from Jindabyne in 1903, and another was sent in from National Park, south of Botany Bay, in 1925.

Chaffer (1930) reported finding a specimen of the Pigmy-possum in French's Forest near Sydney in July 1929. It was in

*Specimens now in A.M. (No. S.566).

the lining of a nest of the Yellow-winged Honeyeater (*Meliphaga novae-hollandiae*), in an area of "banksias, dwarf angophoras, grevilleas, stunted eucalypts and numerous small flowering shrubs". The animal escaped after being photographed. The report, and a picture, appeared also in the *Victorian Naturalist* in May 1930 (Vol. 47, pp. 18-19).

The habitat of Chaffer's Pigmy-possum was apparently the same as that of Krefft's original specimens of *unicolor*, which were "captured near St. Leonard's, North Shore, Sydney, feeding upon the *Banksiae*".*

Marlow (1958) gave data of several subsequent specimens from the Sydney-Blue Mountains area, and of one from near Newcastle. The last was collected in 1958 and constitutes the northernmost record of the species. An additional A.M. specimen, from Bowral (1939), and that from Jindabyne, indicate the continuity of the eastern New South Wales population with that of Victoria.

A specimen had been collected at Western Port, Victoria, in 1880, and the species was included in a list of Victorian mammals by Forbes-Leith and Lucas (1884), as *Phalangista glirformis*. Other early Victorian records are an adult from Muckleford, near Castlemaine, in 1886, and two juveniles from Mordialloc in 1887. These four specimens are in the N.M.V. as are others from Avoca (1918), Buangor (1935), Portland (1946), Erica (1947), Wilson's Promontory (1950) and Mount Lock (1952). The last was from 5400 feet elevation.

In the November 1947 issue of *Wild Life* magazine (Vol. 9, No. 11, p. 418) there are several excellent photographs of the Erica animal. It was found "in a messmate log that was being sawn at the State sawmill". As the log may have been hauled from many miles away, the origin of the specimen is not known.

The F.W.D. (Fisheries and Wildlife Department of Victoria) has three specimens of *nanus* which were collected in the Portland district, about 1945, 1957 and 1959; and in 1948 two were received at the A.M. from the same area. The forest there is of Brown Stringybark (*Eucalyptus baxteri*) and other eucalypts, with considerable areas of dense shrubbery including many species of the Myrtaceae and Proteaceae.

In January 1958, two subadult Pigmy-possums were inadvertently brought away in clothing from a cottage at Tamboon Inlet, in the Cann River district of eastern Victoria. The species is abundant there, in the forest of Mahogany Gum (*Eucalyptus botryoides*), banksia (*B. integrifolia, B. serrata*) and thickets of shrubbery, and several have been seen in local holiday houses. The two specimens were placed in the N.M.V., and one other has subsequently (1962) reached the F.W.D. from Tamboon.

In early 1958, I caught a subadult Pigmy-possum near Mallacoota, in a trap set on the ground in a runway used by bush rats (*Rattus assimilis*). The general vegetation was dry sclerophyll forest, but the actual spot was in tree heath, with an abundance

* Troughton (*l.c.*) wrongly attributes this observation to Gould.

Figure 1: Subadult Pigmy-possums, *Cercartetus nanus*, from Rushworth Forest, Victoria. The branch is Yellow Gum, *Eucalyptus leucoxylon*.

of Spear Grasstree (*Xanthorrhoea hastilis*), numerous sedges, heaths, myrtaceous shrubs, and a scattering of Silver-leaf Stringybark (*Eucalyptus cephalocarpa*). The animal was photographed and released.

The F.W.D. has two recent specimens from Mallacoota (1962, 1963), and one from Nowa Nowa (1960). These records, together with further reports of the species in holiday homes at Cape Conran, near Orbost, indicate its abundance in the coastal vegetation of East Gippsland.

Inland records are more scattered. In the Ballarat district, *nanus* is reported to occur only in a few well-separated places, in Snake Valley and the Grenville area. This information comes from E. G. Bedggood, who is a local fuel merchant and a reliable observer. He and his associates regularly find families of phascogales (*Antechinus*) and Pigmy-possums when shifting wood-stacks which have been drying in the bush for two or three years. But whereas the phascogales are widespread, the Pigmy-possums are localized. There is a medium to dense element of shrubbery in most areas concerned. Two Snake Valley specimens of *nanus*, dated 1961 and 1962, are in the F.W.D. collections.

From other inland stations, the F.W.D. has a specimen from the Rushworth Forest (one of four found in a hollow tree in 1961), a group from Yackandandah (1963), and photographic record of a specimen from Whitlands, 3000 feet up in the highlands of north-eastern Victoria.

The last was found by a timber-getter in October 1958 and was kept in semi-captivity for over four years. It was in quite good health up to the time of its death, by accidental drowning. As it was fully adult when first obtained, and presuming that early spring is the breeding time of the species, this individual lived to an age of at least 5½ years, and it would probably have lived considerably longer.

In total, there are only about forty records of *nanus unicolor*.

All are from general areas of dry sclerophyll forest, and about half are from very close to the coast. This form appears therefore to be widely scattered but uncommon in the highland forests of Victoria and south-eastern New South Wales, and it is apparently less rare in contiguous densely scrubby coastal forests.

Sub-fossil data, discussed on page 113, and Tasmanian records, indicate that, whereas *nanus* does occur both in wet sclerophyll forest and in dry, it prefers the latter habitat.

The Pigmy-possum is lacking from the savannah formations of central Gippsland and of the Western District of Victoria, and from the woodlands of the Monaro district of southern New South Wales. The extensive woodland formation of inland New South Wales and northern Victoria, which extends west to the extreme corner of South Australia, apparently forms a general barrier between *nanus* and *concinnus*.

A pigmy-possum has been reported from McKenzie Creek in the north-western part of the Grampians, but it was not identified. It was probably *nanus*, for sub-fossil remains of this species have been found in the Black Range, slightly further west (unpublished data). But these two places are within twenty miles of the nearest known locality for *concinnus*, and the Grampians constitute an island of forest between the general areas of the two species. They may be sympatric there.

Cercartetus concinnus concinnus

The nominate subspecies is represented in collections by at least 180 specimens, almost all of which are in the Western Australian Museum. These show that the form has a general distribution in the south-western corner of the continent, as far north as Moora, inland to Bulong near Kalgoorlie, and east to Belladonia.

Glauert (1933) recorded that it extended north to Sandstone; but there appears to be no specimen to support this, and the locality is in an area of unsuitable climate and vegetation some 200 miles north of the normal habitat of the form.

Lundelius (1957) found subfossil remains of *concinnus* in "surface material" of the Murraelellevan Cave, 4½ miles west of Cocklebiddy Tank on the Eyre Highway. He postulated that the "topmost one foot" of this and several other cave deposits indicated modern distribution of species found therein. However, recent work in Victorian caves (e.g. Wakefield, 1963) has brought to light exposed surface material that evidently dates back several thousand years.

The Mundarda is abundant in the Jarrah forests (*Eucalyptus marginata*), where there is an undergrowth of sclerophyllous shrubbery containing many of the Myrtaceae and Proteaceae. This formation occurs in a broad band southward from the Swan River to the Blackwood and thence south-easterly towards Albany. In the coastal strip west of the Jarrah country, the possum occurs in the Tuart forest (*E. gomphocephala*) in scrubby areas rather than the true savannah formation. In the extreme south it is absent from the forests of Karri (*E. diversicolor*), where

Figure 2:

Specimens of Mundarda, *Cercartetus concinnus*, from between Kiata and Little Desert, Victoria, 1962. The plant is Desert Banksia, *B. ornata*.

the rainfall exceeds 40 inches per annum.

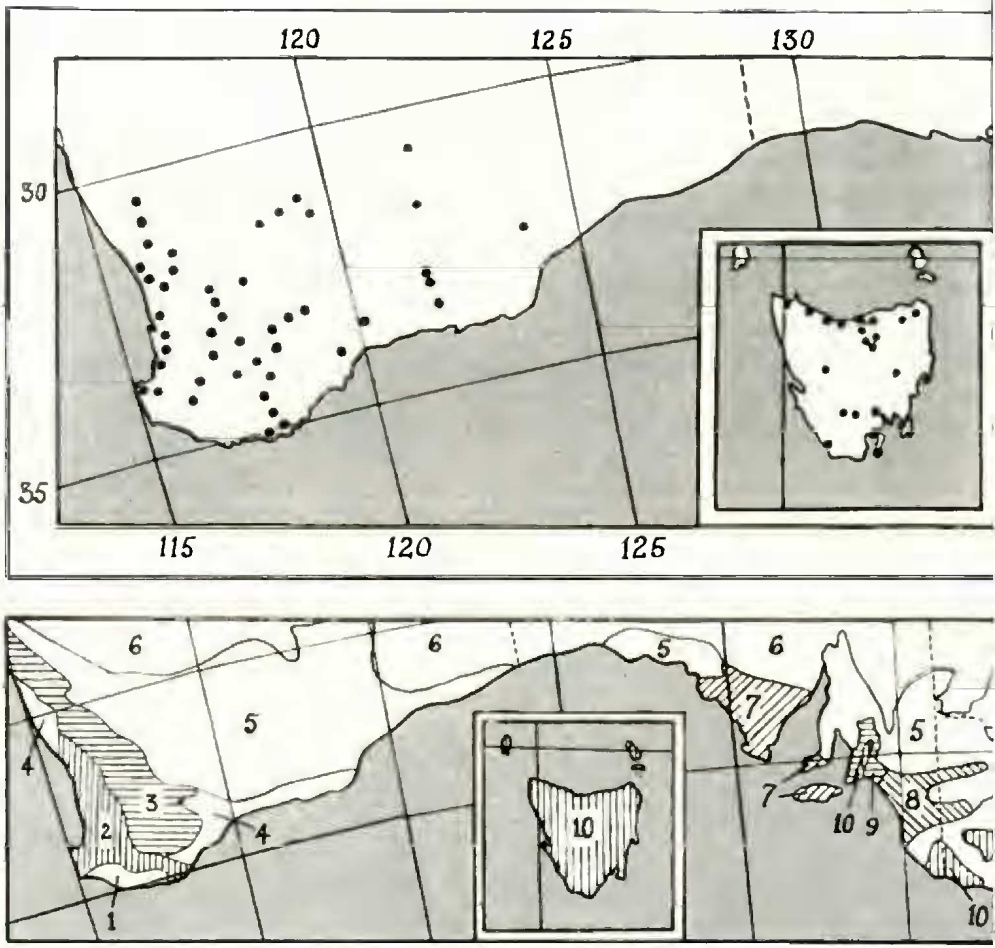
Inland from the Jarrah country, the woodlands dominated by Wandoo (*E. redunca*) do not suit the species. However, within this general Wandoo zone there are areas of a related eucalypt (*E. accedens*), as well as of species of Mallet (*E. astringens, E. gardneri*, etc.), which are accompanied by dense undergrowth suitable for the animal. These Mallet formations extend eastward, well into the general areas of mallee scrub.

The heathland formation, with its abundance of Proteaceae, Myrtaceae and other nectar-producing plants, provides ideal food for *concinnus* but living places are apparently few or lacking. The species is therefore rare or absent from the near-coastal heaths west of Moora, and from the coastal belt between Albany and Israelite Bay. However, in the transitional areas, between heath and woodland or mallee, eucalypts provide homes and conditions are ideal. Alternation of this kind is frequent in the 15-20 inch rainfall zone centred to the north of Albany, and occurs with diminishing frequency as one moves easterly into the drier mallee. At the known limit of the species, the average rainfall is approximately 9 inches per annum.

Neither the drier mallee nor the more northerly mulga bush formations are suitable for the possum; these lack sclerophyllous shrubbery.

The vegetation has been described here in terms used by Gardner (1942), in a lengthy treatment of Western Australian vegetation.

In the terms of Wood and Williams (1960), *concinnus* occurs in the Western Australian sclerophyll forest, sclerophyll shrub woodland, tree heath and sclerophyll mallee; and it is lacking from wet sclerophyll forest, heath, low layered woodland and semi-arid mallee. Therefore it is abundant in the Perth-Albany district, where the necessary formations are dominant, and it becomes rare further east as these formations comprise progres-



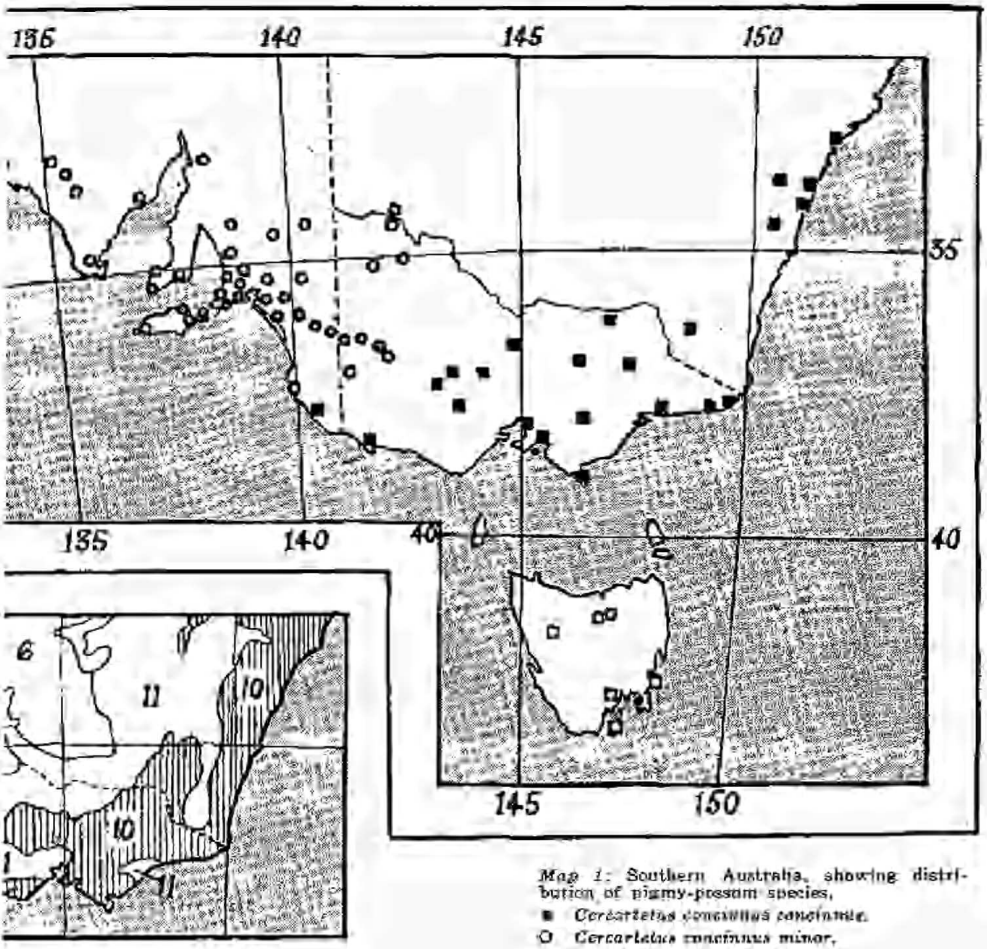
Map 2: Southern Australia, showing general vegetational zones. (Modified from Wood and Williams.)

1. Karri forest.
2. Jarrah forest—Tuart forest.
3. Wandoo forest—sclerophyll mallee.
4. Heath.
5. Semi-arid mallee.
6. Mulga—saltbush.
7. Sclerophyll mallee.
8. Heath-mallee complex.
9. Woodland (South Australia).
10. Dry sclerophyll forest, with some admixture of wet sclerophyll forest, alpine complex and rainforest.
11. Woodland—savannah—grassland.

sively less of the general vegetation.

Cercartetus concinnus minor

There are over 120 museum specimens of the Mundarda from South Australia. About a hundred of these are in the South Australian Museum, but in a number of cases are without record of locality. Last century, the form was known from near Adelaide and as far afield as the Renmark and Port Pirie districts and Kangaroo Island. Early in



Map 1: Southern Australia, showing distribution of pigmy-possum species.
■ *Cercartetus concinnus concinnus.*
○ *Cercartetus concinnus minor.*
■ *Cercartetus nanus unicolor.*
□ *Cercartetus nanus nanus.*
Inset—*Cercartetus lepidus.*

the present century, the collection of further specimens extended its known range to Port Lincoln on the Eyre Peninsula, west to Ceduna on the Great Australian Bight, and into the south-eastern region between the Coorong and the Victorian border.

During the past forty years, material has continued to come in regularly from these general areas of distribution.

The range of *concinnus* in Victoria is mainly demonstrated by some 17 specimens in official collections. The earliest of these are three juveniles, found at Underbool in 1910 by A. H. E. Mattingley. The circumstances of this discovery were discussed by LeSouef and Burrell (1926), but the animals were wrongly identified as *Dromicia nana*.

The Underbool specimens were placed in the N.M.V., and the following year two adults of the

same species arrived there from the Ouyen area. In 1937, a specimen from Serviceton, Victoria, was sent to the South Australian Museum and was correctly registered there as *concinnus*. A further adult specimen reached the N.M.V. from Edenhope in 1952, and two went to the A.M. from Mildura in 1955 but were registered as *C. nanus*. In these circumstances, the species was not credited for Victoria by Brazenor (1950), or in any edition of *Furred Animals of Australia* (e.g. Troughton, 1956).

The Victorian occurrence of the species was well known to naturalists from the early 1930s onward, and K. V. Hateley of Kiata was responsible for the first published details of the species as a native of the state. These appeared in Wimmera district newspapers—the *Horsham Times* of September 14, 1955, and the *Kaniva Times* of November 14, 1955. The reports were of an animal found near Nhill; it was illustrated by a close-up photograph and correctly named "the south-western pigmy possum", and "*Cercartetus concinnus*". The specimen was taken from a babbler's nest in a *Melaleuca* shrub, in *Eucalyptus baxteri* country, two miles SW. of Mount Elgin. It was collected on September 25, 1955, and is now in the collection of the F.W.D.

Ryan (1963) reported finding a specimen in a babbler's nest in the fringe of the Little Desert near Kiata in December 1961, and at the same time summarized data of certain N.M.V. specimens. Ryan ascertained that a "Mildura" specimen (No. C.2848, collected by W. Roberts in early July 1958) had originated at Trentham Cliffs, on the north side of the Murray River, thus establishing that *Cercartetus concinnus* is native in New South Wales.

During 1962, besides the type from Nurcoung, the F.W.D. received examples of *concinnus minor* from Worrigworm, Bridgewater's Corner and Winiam, three localities between Kiata and the Little Desert. (See Figure 2.)

Mattingley's Underbool specimens were found in a nest of leaves in a hollow mallee trunk, and a similar home was noted at Padthaway, 30 miles north of Naracoorte (R. Attiwill, *in litt.*, 2.6.1962). Several have been located in disused nests of the Grey-crowned Babbler (*Pomatostemus temporalis*), particularly about the Little Desert.

On October 20, 1958, a pupil of the Stewart school found three in the nest of a Zebra Finch (*Taeniopygia castanotis*) in a roadside clump of mallee about three miles from Red Cliffs. These were released, but the record is substantiated by clear colour photographs taken by A. B. West of Red Cliffs. Another pictorial record of the species is held by A. J. Hicks of Kaniva, of a specimen found at Sandsmere, nine miles NE. of Kaniva, in about 1957.

C. O. Kroker of Horsham has a series of excellent photographs, both in half-tone and colour, of specimens of *concinnus* found at Nurrabiel, about 16 miles SW. of Horsham, in December 1957. An adult pair and one subadult, these were released at the Wail Forest Nursery and may be ancestors of a subadult which

Figure 3:
Habitat of the Mundarda, *Cercartetus concinnus*, on the fringe of the Little Desert, near Kiata, Victoria. The foreground shrubbery is *Banksia ornata* and *B. marginata*, with *Eucalyptus incrassata* behind, and *E. baxteri* in the background.

reached the N.M.V. from the nursery in December 1961.

A specimen is reported (G. B. Eggleton, *in litt.*, 7.4.1962) to have been caught at Lascelles and released at Hattah Lakes; and K. Hateley habitually takes victims of clearing operations in the Kiata area to the local Lowan Sanctuary. These commendable conservation activities should be noted in connexion with future considerations of natural distribution.

The status of *concinnus minor* in local vegetation formations is similar to that of the western race.

The Mount Lofty Ranges carry dry sclerophyll forest, with Messmate (*Eucalyptus obliqua*), Brown Stringybark (*E. baxteri*), Long-leaf Box (*E. elaeophora*) and various myrtaceous and proteaceous shrubs. The surrounding woodlands give way in places to suitable habitats of sclerophyllous shrub vegetation. Sclerophyll mallee originally covered most of the Eyre Peninsula, Kangaroo Island, and the extremity of the Yorke Peninsula; and it contributes, with tree heath and mallee heath, to a complex vegetation which extends eastward from the Coorong to the Victorian border and beyond. The same mixture provides the ideal *concinnus* habitat in the vicinity of the Little Desert and Big Desert of Victoria's Western Wimmera. A typical situation is where sand ridges with Brown Stringybark and banksia give way on the one hand to tree heath and on the other to a mallee association of *Eucalyptus incrassata, Melaleuca uncinata* and numerous small shrubs. (See Figure 3.)

In the Victorian Mallee and the Murray River district of South Australia, to the east of Spencer Gulf, and towards the

eastern end of the Great Australian Bight, there are tracts of semi-arid mallee where the main eucalypts are *E. oleosa*, *E. pileata* and *E. dumosa*. The Mundarda occurs sparsely in these general areas, but in places where less arid conditions allow the development of considerable sclerophyllous shrubbery. As in Western Australia, the limit of distribution of the species in these eastern mallee areas is about the nine-inch annual isohyet. The Mildura-Renmark tract of the Murray River lies approximately along this line.

The species is probably absent from the pure heath formations of the Victorian "deserts", and again, in inland South Australia, it does not reach the low-layered woodland (mulga scrub).

Map 1 shows the distribution of the subspecies of *nanus* and *concinnus*, and its inset shows localities for *lepidus*. Map 2 is of general vegetation types discussed in this paper.

Like *nanus*, the Mundarda is not averse to appropriating man-made homes. Near Kiata, one was found under a bag on the seat of a tractor. At Keith, S.A., they are reported to take up abode occasionally in the tubular seed drills of wheat planters. And, on a farm near Meningie, L. D. Williams observed (*in litt.*, 5.5.1961) that *concinnus* was found "often under stumps and on a couple of occasions in the piping of a disused windmill".

Sometimes the little animals come to grief in man-made objects. A Portland district Pigmy-possum (*nanus*) was trapped in a petrol tin, while another was drowned in a rain-gauge at Mallacoota. And R. H. Hobson reports (*in litt.*, 2.4.1961) that a specimen of Mundarda was drowned in a billy hanging on a fence under a gumtree at Yaapeet in the southern Mallee.

Cercartetus lepidus lepidus

Of this form, there appear to be only three museum specimens which date back to last century (all in the B.M.), but a total of over fifty have reached various museums during the present century. In the past sixty years the B.M. acquired eleven, the Hobart Museum received twelve from 1920 onward, and all twenty specimens at the Launceston Museum were registered during the past thirty years.

These details indicate that, in contrast to *nanus*, the status of *lepidus* has changed from rarity to abundance during the past hundred years. The decline of the one, and the re-establishment of the other, are most likely due to the marked changes in vegetation brought about by the periodic forest fires that have occurred in Tasmania ever since European settlement there.

The Little Pigmy-possum has been recorded in various near-coastal parts of northern Tasmania from Smithton to the Derby area, at Lake St Clair, Campbell Town and the Florentine Valley in central districts, and as far south as Port Davey and Bruny Island.

A little information is available about the habitat of *lepidus*. A story was told by Skemp (1950) of one brought to light by a road patrol-man "shelling dry bits from an old log by the roadside" at the Sideling, west of Scottsdale. That is heavily forested country, about 2000 feet

Little Pigmy-possum, *Cercartetus lepidus*, from Moogara, Tasmania, 1962.

above sea level, with an annual rainfall of about sixty inches.

Hickman and Hickman (*l.c.*) reported that they obtained two specimens near a creek in a heavily timbered valley at the foot of Mount Wellington, one in 1956 "curled up in a small cavity in the broken end of an exposed root of a fallen tree", and the second in 1957 in a "small dome-shaped nest of bark fibres . . . inside a broken hollow branch of a fallen tree."

R. H. Green (*in litt.*, 15.3.1962) told of one in the Tamar area with a small bark fibre nest "inside the barrel of a green gum sapling, the centre of which had rotted away", and a pair "turned up among turf sods when an old fallowed paddock was being cultivated".

C. lepidus (Mainland)

Ride (1960) identified several fossil specimens of *lepidus* in limestone breccia from Wombeyan, eastern New South Wales. He considered their age to be Upper Pleistocene and probably from the period since the last pluvial. In the breccia, more specimens of *nanus* were found than of *lepidus*.

Wakefield (1960) reported both species in a sub-fossil deposit at the Pyramids, near Buchan in eastern Victoria. Again *nanus* was much more plentiful than *lepidus*. Analysis of the Pyramids material indicates that, as *lepidus* declined in status and eventually disappeared, *nanus* became even more abundant. This development appears to have been linked with a vegetational change in the locality from wet sclerophyll forest to dry sclerophyll forest, between the latest Pleistocene pluvial period and a mid-Holocene arid period.

Cercartetus caudatus caudatus

The specimens dealt with by Tate and Archbold (*l.c.*) and Laurie (*l.c.*) indicate a general distribution from the extreme east of New Guinea to at least as far west as the Bismarck Ranges of north-eastern New Guinea and the Central Division of Papua. Presumably the species occurs also between these places and the type locality, but there is no information available to confirm this.

Laurie's animals came mainly from country between about 6000 and 8000 feet above sea level. Tate's Papuan specimens were from 3100 feet elevation, but the height he gives for the Huon Peninsula locality (3700 metres) is obviously an error.

C. caudatus macrurus

There are only eight museum specimens of the Queensland race of the Long-tailed Pigmy-possum, all from within fifty miles of Cairns.

Mjöberg obtained three males and a female "in tropical jungle near Cedar Creek on the Atherton Tableland" in April 1913. They were "lying rolled up close together". These four are in the Swedish State Museum, Stockholm.

The Queensland Museum has two specimens. No. J.6571 was found, as a skeleton, in a nest at Jordan Creek near Innisfail. No. J.7011 was brought in by a cat, in May 1944, at Mount Carbine near Molloy.

The A.M. has a specimen (No. M.5433) which Troughton (*l.c.*) says was found "in a small dome-shaped nest . . . of grass . . . twelve feet from the ground in a tree in the scrub at Tinaroo". It was collected in 1908 but not identified until recently.

The American Museum of Natural History received a specimen (No. 155090) from the Atherton Tableland in 1948.

There is no indication as to whether or not the nests mentioned here were in hollows or that they had been made by the pigmy-possums. Nothing is known of the habits of this Queensland group.

APPENDIX: GENERIC TAXONOMY

For three-quarters of a century the genus name *Dromicia* Gray was in use for several small possums. This included four pigmy-possum species—*nana*, *concinna* and *lepida* of southern Australia, and the New Guinea *caudata*.

Mjöberg (*l.c.*) described a new genus, *Eudromicia*, and a new species, *E. macrura*, from tropical Queensland. In this genus he placed both *caudata* and *lepida*, thus leaving *Dromicia* with two species—*nana* and *concinna*. He stated that *Eudromicia* differed from *Dromicia* in having the full number of molars (i.e. four), strongly developed P^3, two-rooted P^1 and P_2, the squamosal part of the zygomaticum not inflated, and the bullae not swollen.

Iredale and Troughton (*l.c.*) accepted Mjöberg's grouping, but instead of *Dromicia* they used the genus name *Cercartetus* Gloger for *nanus* and *concinnus*. Gloger's genus predated Gray's by several months.

Simpson (1947) adopted *Cercaërtus* Burmeister instead of *Cercartetus*, evidently depending on a statement by Thomas (1888) that the second was obviously a mis-spelling of the first. But the original description by Burmeister (1837) is as follows:

> Eine besondere Gatt. (Cercaërtus Glog.) bildet die mit buschigem Schwanz begabte gemaine Art *Ph. vulpina*.

Phalangista vulpina (Meyer) is an absolute synonym of *Didelphis vulpecula* Kerr, and the latter is the type of *Trichosurus* Lesson. Therefore, as placed in Iredale and Troughton (*l.c.*), *Cercaërtus* is a junior synonym of *Trichosurus*.

Although the name *Cercaërtus* was apparently drawn from Gloger's then unpublished manuscript, the case for mis-spelling cannot stand. There is no reason to doubt that in 1841 Gloger deliberately used the spelling *Cercartetus* for a new genus with *Phalangista nana* as the type species.

Simpson (*l.c.*) did not recognize *Eudromicia* as a distinct genus but placed it, without comment, as a synonym of his "*Cercaërtus*". His action appears to be justified for these reasons:

1. In proportion to the size of the skull, the tympanic bullae are equally swollen in *nanus* and *concinnus*; those of *lepidus* are slightly less swollen, and those of *caudatus* are hardly swollen at all.

2. The squamosal inflation is greatest in *concinnus*, less in *nanus*, and less still but quite definite in *caudatus*. In *lepidus* there is no squamosal inflation at all.

3. The posterior upper premolar (P^1 actually) is not conspicuously more developed in any of the four species.

4. Characters of the small upper premolars vary within a species. There are normally two such teeth (usually known as P^3 and P^4), but at least in *nanus*, *concinnus* and *lepidus*, an additional small tooth (evidently P^2) may be present. In *lepidus* these teeth are acute with two divergent roots. In *concinnus* they are normally single-rooted, but either may have two contiguous roots. In *nanus* they are usually single-rooted but P^4 may be double-rooted; and in *caudatus* they are normally double-rooted but P^3 may be single-rooted or with two contiguous roots.

5. In *lepidus*, M^1 is not much modified, and it fits into a regular size gradient with M^2 and M^3. But, compared with M^2 and M^3, the M^1 of *caudatus* is so small as to be almost obsolete. In *concinnus*, M^3 has two distinct posterior cusps, whereas in *nanus* the posterior cusps of M^3 are obsolete. With each of the four species having a different pattern of molar sizes, the presence of M^1 in the first two does not justify placing them together as a separate genus.

The details given in these five paragraphs, and other points set out elsewhere in this paper, indicate that there is no natural grouping amongst the species of pigmy-possum.

In this connexion the development of the anterior cusps (protoconid and metaconid) of M_1 is of interest. In *lepidus* each of these cusps is of medium size. Both *caudatus* and *nanus* have the former strongly developed and the latter obsolete. In *concinnus*, M_1 has a very large fang-like protoconid, and the metaconid is lacking.

In 1916, Matschie proposed new genera, *Dromiciella* and *Dromiciola* for *concinnus* and *lepidus* respectively. The adoption of either or both of these as monotypic genera appears to be more justifiable than the use of *Eudromicia* for *caudatus*.

There is no advantage to be gained by classifying the pigmy-possums into four monotypic genera, and the alternative is to adopt *Cercartetus* for all four species. The latter course should be followed, pending some understanding of their phylogeny.

Summary

Features of Australian pigmy-possums are given, and key features by which the four species can be identified.

Taxonomy is revised as follows:

(a) The generic name *Cercartetus* Gloger is shown to be valid rather than *Cercaëtus* Burmeister, and *Eudromicia* Mjöberg is discarded as a genus and its species placed in *Cercartetus*.

(b) In *C. nanus*, the Tasmanian subspecies *C. n. nanus* and the mainland Australian subspecies *C. n. unicolor* are recognized, but *Dromicia britta* Jones is not distinguished from the latter.

(c) In *C. concinnus*, the nominate subspecies is restricted to Western Australia, and the eastern Australian population is distinguished under a new subspecific name, *C. c. minor*.

(d) The Queensland *Eudromicia macrura* is shown to be conspecific with the New Guinea *C. caudatus*, and the former is reclassified as *C. c. macrurus*.

Distribution and habitat of each subspecies are discussed, and it is shown that the status of *nanus* and *concinnus* in their respective areas is largely dependent on the occurrence of dry sclerophyll shrubbery in conjunction with trees.

Acknowledgements

I wish to acknowledge the assistance given by the Directors and staff members of the museums and other institutions, in Australia and overseas, from which data have been gathered in the preparation of this paper. Considerable help has been forthcoming too from the many naturalists who have made available their observations.

Expenses of interstate travel in connexion with the research were met by the C.S.I.R.O. Science and Industry Endowment Fund, and the cost of illustrations and of some of the field work have been defrayed from the M. A. Ingram Trust.

References

Bell, Thomas, 1829. Description of a new species of *Phalangista*. *Trans. Linn. Soc. Lond.*, *16*: 121.

Brazenor, C. W., 1950. *The Mammals of Victoria*. National Museum of Victoria, Melbourne.

Broom, R., 1896. Report on a bone breccia deposit near the Wombeyan Caves, N.S.W.; with descriptions of some new species of marsupials. *Proc. Linn. Soc. N.S.W., 21*: 48-61.

Burmeister, C. H. C., 1837. *Handbuch der Naturgeschichte. II. Zoologie*, p. 814.

Chaffer, N., 1930. The opossum mouse (*Dromicia nana*). *Aust. Zool., 6* (2): 109, pl. 12.

Forbes-Leith, T. A., and Lucas, A. H., 1884. Catalogue of the fauna of Victoria. Vertebrata: Mammalia. *Vict. Nat., 1* (2): 4-6 (=12-14).

Gardner, Charles Austin, 1942. The vegetation of Western Australia with special reference to the climate and soils. *J. Roy. Soc. W. Aust., 28*: 11-87.

Glauert, L., 1933. The distribution of the marsupials of Western Australia. *J. Roy. Soc. W. Aust., 19*: 17-82.

Gould, John, 1845. *Proc. Zool. Soc. Lond., 1845*, p. 2.

————, 1846. *The mammals of Australia*, vol. 1, plate 9.

Hickman, V. V., and Hickman, J. L., 1960. Notes on the habits of the Tasmanian dormouse phalangers *Cercartetus nanus* (Desmarest) and *Eudromicia lepida* (Thomas). *Proc. Zool. Soc. Lond., 135* (3): 365-374.

Iredale, Tom, and Troughton, E. LeG., 1934. *A checklist of the mammals recorded from Australia*. Australian Museum, Sydney.

Jones, Frederick Wood, 1925. A new South Australian dormouse opossum. *Trans. Proc. Roy. Soc. S. Aust., 49*: 97.

Krefft, Gerard, 1863. Description of a new species of the genus *Dromicia* discovered in the neighbourhood of Sydney. *Proc. Zool. Soc. Lond., 1863*, p. 49.

Laurie, E. M. O., 1952. Mammals collected by Mr. Shaw Mayer in New Guinea, 1932-1949. *Bull. Brit. Mus. (Nat. Hist.) Zool., 1* (10): 271-318.

LeSouef, A. S., and Burrell, Harry, 1926. *The Wild Animals of Australasia*. George & Harrap, London.

Lundelius, Ernest, 1957. Additions to our knowledge of the ranges of Western Australian mammals. *W. Aust. Nat., 5*: 173-182.

Marlow, B. J., 1958. A survey of the marsupials of New South Wales. *C.S.I.R.O. Wildlife Research, 3* (2): 71-114.

Mjöberg, Eric, 1916. On a new genus and species of marsupials. *Kungl. Svenska Vetensk. Handl., 52* (2): 13-14.

Péron, François, 1807. *Voyage de découvertes aux Terres Australes, sur les corvettes la Géographe, le Naturaliste, et la goëlette le Casuarina, 1800-4, vol. 1*. Paris.

Ride, W. D. L., 1960. The fossil mammalian fauna of the *Burramys parvus* breccia from the Wombeyan Caves, New South Wales. *Journ. Roy. Soc. W. Aust., 43* (3): 74-80.

Ryan, R. Mark, 1963. Occurrence of the western pigmy possum, *Cercaërtus concinnus*, in Victoria and New South Wales. *Vict. Nat., 79* (11): 337-340.

Simpson, George Gaylord, 1947. The principles of classification and a classification of mammals. *Bull. Amer. Mus. Nat. Hist., 85*: 1-350, p. 45.

Skemp, J. R., 1950. The story of . . . Tasmania's smallest marsupial. *Wild Life, Australian Nature Magazine, 12* (1): 8-10.

Tate, G. H. H., 1945. Results of the Archbold Expeditions. No. 55. Notes on the squirrel-like and mouse-like possums (Marsupialia). *Amer. Mus. Novitates, 1305*.

————, and Archbold, Richard, 1937. Results of the Archbold expeditions. No. 16. Some marsupials of New Guinea and Celebes. *Bull. Amer. Mus. Nat. Hist., 73*: 331-476.

Thomas, Oldfield, 1888. *Catalogue of the Marsupialia and Monotremata in the collections of the British Museum (Natural History)*. British Museum, London.

Troughton, Ellis, 1957. *Furred animals of Australia, Ed. 6*. Angus & Robertson, Sydney.

Wakefield, N., 1960. Recent mammal bones in the Buchan district—2. *Vict. Nat., 77* (8): 227-240.

————, 1963. Sub-fossils from Mount Hamilton, Victoria. *Vict. Nat., 79* (11): 323-330.

Waterhouse, G. R., 1846. *A natural history of the Mammalia, vol. 1*. Hippolyte Ballière, London.

Wood, J. G., and Williams, R. S., 1960. Vegetation, in *The Australian Environment, Ed. 3*, pp. 67-84. C.S.I.R.O., Melbourne.